Supplementary materials for Afonso et al. Trophic-mediated pelagic habitat structuring and partitioning by sympatric elasmobranchs

Table S1. Standardized diet compositions, in percentages, of *Carcharhinus falciformis*, *Galeocerdo cuvier*, *Prionace glauca*, and *Sphyrna lewini*, estimated with stomach content data provided by multiple studies. The number of studies per species (n) and the number of stomachs analysed (N) are reported. Prey categories correspond to teleosts (Teleo), cephalopods (Ceph), mollusks (Mol), crustaceans (Cru), birds (Bir), reptiles (Rep), mammals (Mam), chondrichthyans (Cho), zooplankton (Zoo), other invertebrates (Inv), and vegetable organisms (Veg). Numbers in bold depict the most represented prey categories required to attain a cumulative percentage > 90% of the diet composition for each species. Adapted from Cortés (1999).

Species	**n**	**N**	**Teleo**	**Ceph**	**Mol**	**Cru**	**Bir**	**Rep**	**Mam**	**Cho**	**Zoo**	**Inv**	**Veg**
C. falciformis	9	47	**63.8**	**32.7**	0	3.4	0	0	0	0	0	0	0
G. cuvier	13	1209	**35.4**	**4.8**	0.6	**12.2**	**10.4**	**23.8**	4.6	**8**	0	0.2	0.1
P. glauca	14	1293	**38.5**	**49.4**	0.2	**5**	0.3	0	0.2	0.4	4.9	1	0.2
S. lewini	13	1253	**61.9**	**15.5**	0.1	**22**	0	0	0	0.5	0	0	0

Table S2. Tag deployment summary for 6 pelagic elasmobranch species (*Carcharhinus falciformis*, *Galeocerdo cuvier*, *Mobula tarapacana*, *Prionace glauca*, *Rhincodon typus*, and *Sphyrna lewini*) tracked in the western equatorial and tropical South Atlantic Ocean, with information on shark total length (TL) or ray disk width (DW) in centimeters, sex (male – M; female – F), type of tag deployed (MiniPAT or mk-10), deployment date (dd/mm/yyyy) and time (HH:MM UTC), deployment longitude (Dep.lon,) and latitude (Dep.lat) in decimal degrees, pop-up date (dd/mm/yyyy) and time (HH:MM UTC), pop-up longitude (Pop.lon) and latitude (Pop.lat) in decimal degrees, and deployment span in days.

Species	TL/DW (cm)	Sex	Tag	Deploy Date/Time	Dep.lon (º)	Dep.lat(º)	Popup Date/Time	Pop.lon(º)	Pop.lat(º)	Span (d)
C. falciformis	180	M	MiniPAT	25/06/2013 22:00	-29.33	0.91	12/07/2013 07:00	-32.51	1.91	16
C. falciformis	130	M	mk-10	02/10/2010 20:00	-29.33	0.91	06/10/2010 04:00	-29.30	0.62	3
C. falciformis	157	M	mk-10	02/02/2012 05:00	-29.33	0.91	17/04/2012 22:00	-29.32	0.91	76
G. cuvier	238	F	mk-10	02/08/2012 16:30	-32.42	-3.81	05/08/2012 19:38	-32.15	-4.23	3
G. cuvier	310	F	mk-10	12/08/2012 17:00	-32.43	-3.82	23/08/2012 07:32	-32.15	-3.63	11
G. cuvier	240	F	mk-10	01/08/2012 18:50	-32.43	-3.82	06/11/2012 07:02	-32.33	-4.25	97
G. cuvier	156	F	mk-10	09/09/2012 00:00	-34.84	-8.23	07/12/2012 20:18	-35.15	-19.60	90
G. cuvier	120	F	mk-10	05/03/2011 09:15	-34.85	-8.14	14/05/2011 00:00	-34.76	-6.99	70
G. cuvier	170	M	mk-10	11/07/2011 17:00	-34.76	-8.17	09/09/2011 01:46	-37.91	-12.57	59
G. cuvier	212	F	mk-10	01/08/2012 18:30	-32.43	-3.82	28/11/2012 03:32	-32.73	-4.18	118
G. cuvier	162	M	mk-10	02/11/2013 13:35	-34.85	-8.23	03/03/2014 20:00	-34.93	-8.38	121
G. cuvier	180	F	mk-10	24/08/2012 09:45	-34.93	-8.36	22/09/2012 20:00	-36.90	-17.50	29
G. cuvier	156	M	mk-10	14/08/2011 12:00	-34.91	-8.24	13/10/2011 01:10	-34.69	-7.10	60
G. cuvier	172	F	mk-10	23/08/2011 10:00	-34.91	-8.25	31/08/2011 09:00	-34.70	-7.07	8
G. cuvier	295	F	mk-10	06/01/2011 09:30	-34.69	-8.20	12/04/2011 00:00	-37.20	-3.65	96
G. cuvier	193	M	mk-10	24/07/2009 10:30	-34.89	-8.16	28/07/2009 06:00	-34.69	-7.26	4
G. cuvier	128	F	mk-10	01/06/2010 08:17	-34.77	-8.20	13/08/2010 00:00	-34.67	-7.98	73
G. cuvier	190	F	mk-10	21/12/2010 08:00	-34.67	-8.33	13/01/2011 01:00	-35.59	-5.03	23

G. cuvier	190	M	mk-10	08/02/2011 08:40	-34.68	-8.18	03/03/2011 08:00	-37.08	-3.51	23
M. tarapacana		F	mk-10	25/05/2014 13:00	-29.34	0.91	22/08/2014 01:00	-30.26	0.64	89
M. tarapacana		F	mk-10	01/06/2014 09:00	-29.34	0.91	29/09/2014 09:00	-22.20	3.81	120
M. tarapacana	245	F	mk-10	22/03/2010 14:00	-29.34	0.91	11/04/2010 10:00	-26.29	1.44	20
M. tarapacana	270	F	mk-10	30/06/2011 13:00	-29.34	0.91	05/07/2011 10:00	-30.17	2.06	5
M. tarapacana	250	M	mk-10	26/04/2014 11:00	-29.34	0.91	23/08/2014 23:00	-21.49	3.91	120
P. glauca		F	mk-10	16/05/2011 17:00	-34.27	-6.45	07/07/2011 14:00	-37.55	-15.85	52
P. glauca		M	mk-10	16/05/2011 17:00	-34.52	-5.55	19/06/2011 01:00	-36.32	-4.37	33
R. typus	600	M	mk-10	06/03/2011 09:00	-29.34	0.91	19/03/2011 08:00	-22.29	1.01	13
R. typus	900	F	mk-10	27/03/2010 11:00	-29.34	0.91	14/04/2010 14:30	-32.48	3.43	18
R. typus	900	F	mk-10	19/06/2009 09:00	-29.34	0.91	01/07/2009 04:10	-34.43	1.48	12
S. lewini	250	F	mk-10	08/10/2010 09:00	-29.28	0.86	18/10/2010 01:00	-29.29	0.94	10
S. lewini	260	F	mk-10	06/10/2010 07:00	-29.31	0.85	10/10/2010 09:20	-28.59	1.27	4
S. lewini	200	F	mk-10	28/03/2012 00:00	-29.33	0.91	09/06/2012 04:00	-29.42	0.85	73
S. lewini	219	F	mk-10	13/04/2014 00:00	-29.31	0.85	10/08/2014 16:00	-32.09	1.02	120
S. lewini	210	M	mk-10	13/04/2014 00:00	-29.31	0.85	10/08/2014 19:00	-31.01	1.15	120
S. lewini	205	M	mk-10	03/05/2014 00:00	-29.31	0.85	02/09/2014 10:00	-25.96	-0.33	122

Table S3. Post-hoc, multiple comparison Dunn test results for the effect of trophic level (classes 3.5, 3.8, 4.1, and 4.2) on pelagic elasmobranch maximum diving depths, including the Z statistics, p-values, and adjusted p-values following the Holm method (p-adj) for each comparison.

Trophic level pairs	**Z**	**p**	**p-adj**
3.5 – 3.8	2.770497	0.006	0.006
3.5 – 4.1	7.172770	< 0.0001	< 0.0001
3.5 – 4.2	8.541256	< 0.0001	< 0.0001
3.8 – 4.1	6.256509	< 0.0001	< 0.0001
3.8 – 4.2	7.582088	< 0.0001	< 0.0001
4.1 – 4.2	4.340911	< 0.0001	< 0.0001

Table S4. Stepwise model selection procedure for three INLA regression models of the effect of feeding habit (FeedHab) and the diel period (DielPer) on pelagic elasmobranch maximum diving depths (*maxDepth*), and proportion of time spent in epipelagic (≤ 200 m) waters (*T200*) and in surface (≤ 10 m) waters (*T10*). Model response variables, candidate predictors, and deviance information criteria (DIC) are informed. All models included a random factor to distinguish between individual elasmobranchs.

Response	**Candidate predictors**	**DIC**
maxDepth	FeedHab	-2798.86
	FeedHab + FeedHab: DielPer	-2869.68*
	FeedHab + DielPer + FeedHab:DielPer	-2869.68
T200	FeedHab	1275.86*
	FeedHab + FeedHab:DielPer	1283.12
	FeedHab + Diel Per + FeedHab:DielPer	1281.42
T10	FeedHab	1628.82
	FeedHab + FeedHab:DielPer	1559.44*
	FeedHab + Diel Per + FeedHab:DielPer	1559.11

*Best DIC score for each stepwise model selection procedure

Table S5. Means and credibility intervals of 95% (Inferior and Superior) for marginal posterior distributions estimated by a Gaussian INLA model to assess the effect of a set of predictor variables on pelagic elasmobranch maximum diving depth. The model included feeding habit (FeedHab; as generalist, specialist, and filter-feeding), the diel period (DielPer; as day and night), and the interaction of FeedHab with the diel cycle as predictor variables. Tag deployment was included as a random factor.

Parameter	**Mean**	**Inferior**	**Superior**
Intercept	1.539	1.493	1.586
FeedHab:Generalist	-0.121	-0.178	-0.065
FeedHab:Specialist	-0.067	-0.129	-0.005
FeedHab:Filter-feeder x DielPer:Night	-0.067	-0.084	-0.050
FeedHab:Generalist x DielPer:Night	0.009	-0.004	0.022
FeedHab:Specialist x DielPer:Night	0.024	0.010	0.038
Precision for the Gaussian observations	185.951	171.021	201.039
Precision for random factor	255.597	135.680	386.114

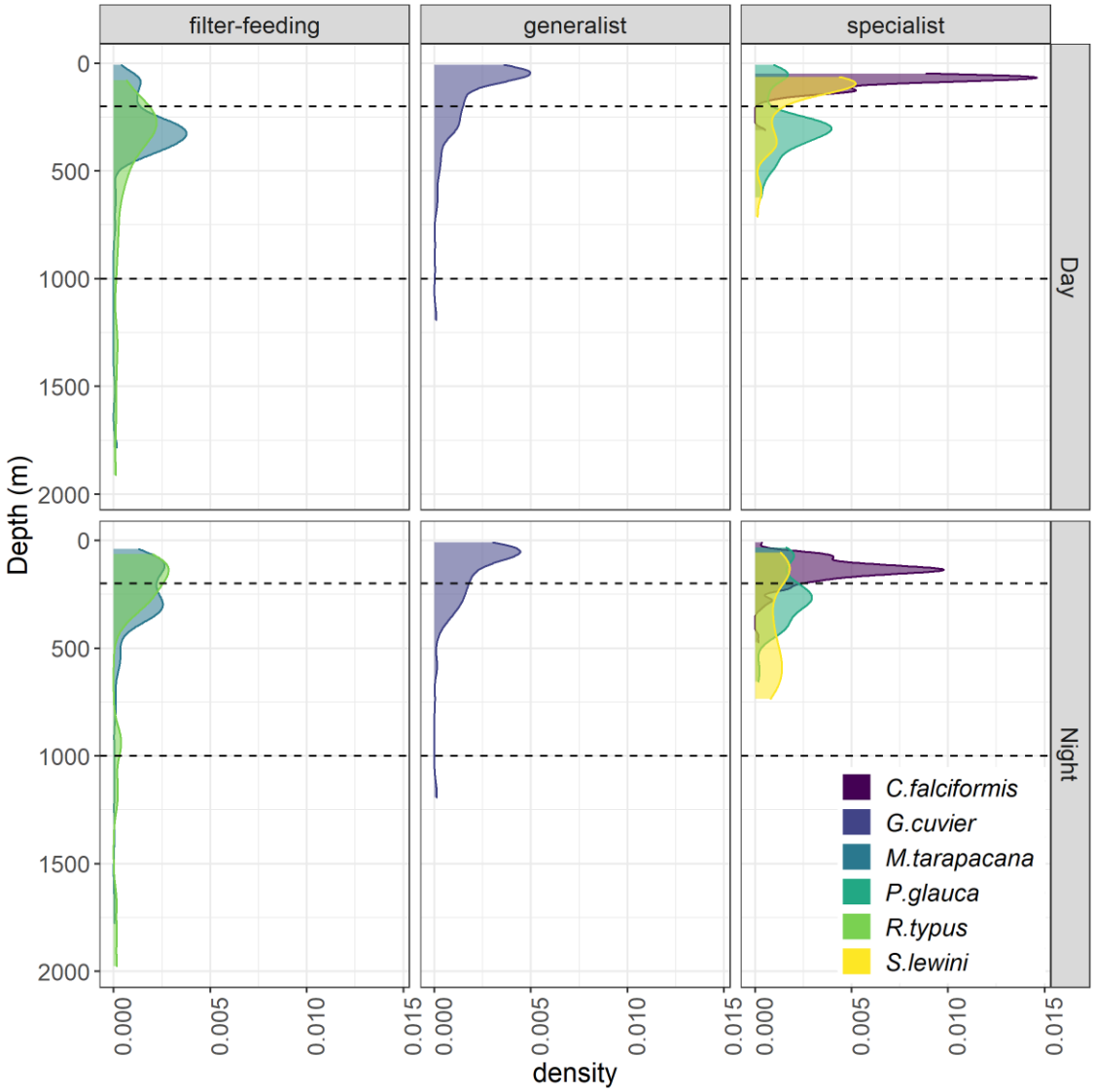

Figure S1. Density plot of the smoothed distribution of pelagic elasmobranch maximum diving depths (*maxDepth*, in meters) grouped by species feeding habits (filter-feeding, generalists, and specialists) for each diel phase (i.e., day in the top row, night in the bottom row), with different species being discriminated by colors. The upper and lower horizontal dashed lines depict the 200- and 1000-m isobaths, respectively.

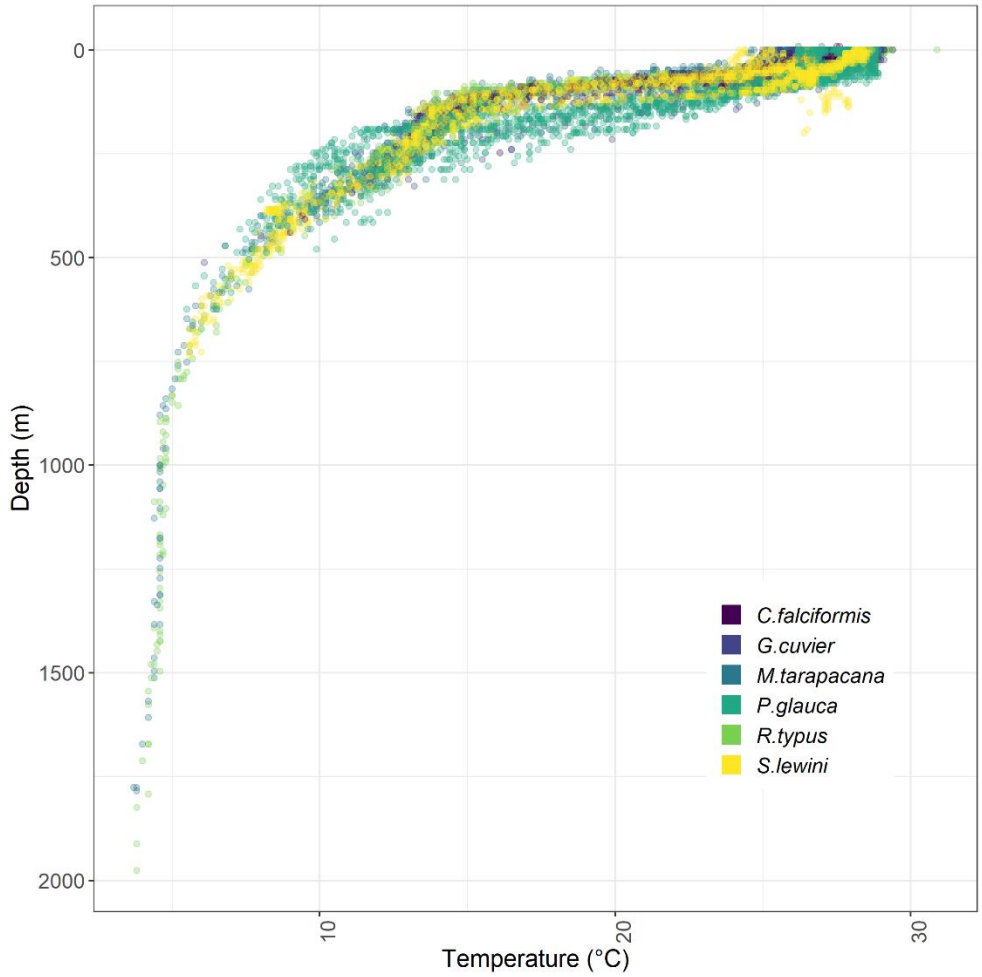

Figure S2. Vertical profile of seawater temperature associated with pelagic elasmobranch movements in the western South Atlantic Ocean, as measured by pop-up satellite archival tags. Colors represent elasmobranch species (i.e., *Carcharhinus falciformis*, *Galeocerdo cuvier*, *Mobula tarapacana*, *Prionace glauca*, *Rhincodon typus*, and *Sphyrna lewini*).

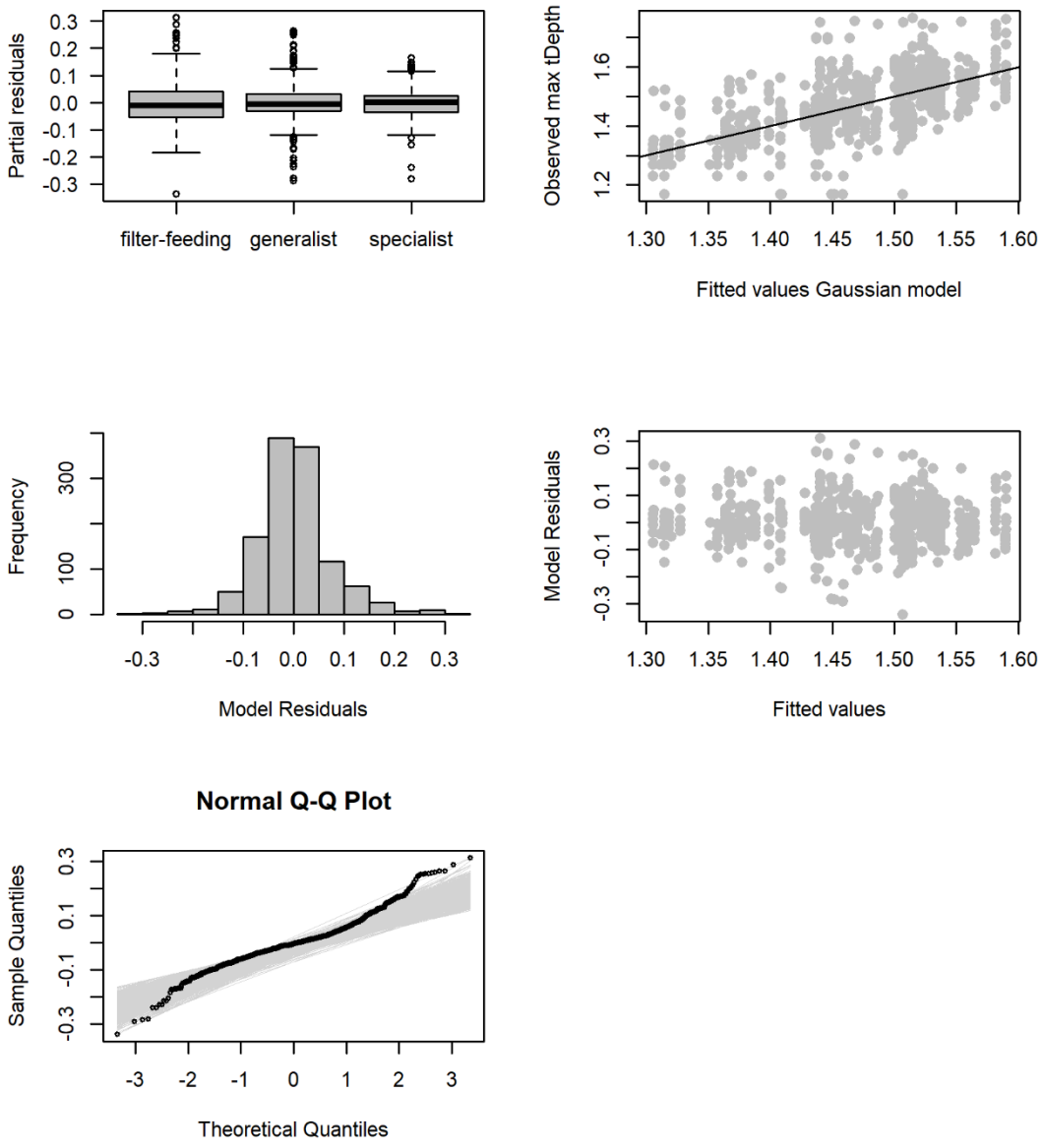

Figure S3. Diagnostic plots for the Bayesian generalized linear model with integrated nested Laplace approximation developed to assess the effects of feeding habit and the interaction of feeding habit with the diel cycle on elasmobranch maximum diving depths (*maxDepth*). The grey area in the normal Q-Q plot (i.e., bottom panel) depicts a simulated envelope of model residuals obtained from a random normal distribution following 500 simulations with 200 observations each.

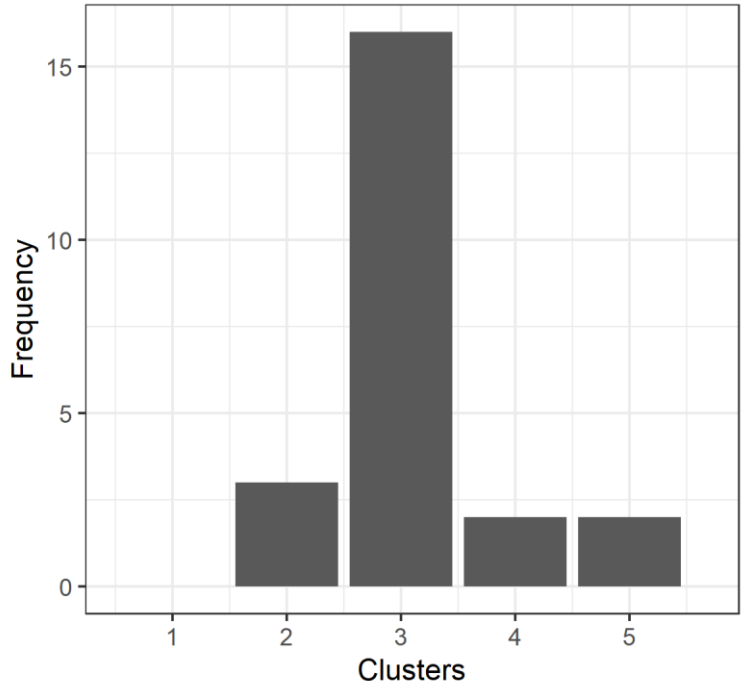

Figure S4. Determination of the optimal number of clusters to be considered in multivariate analysis based on the output of the NbClust R package for a total of 23 different indices. The number of clusters supported by a higher number of indices, depicted on the vertical axis, was chosen.